



UNIVERSITY EXAMINATIONS
FIRST YEAR EXAMINATION FOR THE AWARD OF THE DEGREE OF
BACHELOR OF SCIENCE IN MATHEMATICS
SECOND SEMESTER 2022/2023
[JANUARY-APRIL, 2023]

MATH 112: BASIC MATHEMATICS

STREAM: Y1S2

TIME: 2 HOURS

DAY: THURSDAY, 9:00 – 11:00 AM

DATE: 30/03/2023

INSTRUCTIONS

- 1. Do not write anything on this question paper.**
- 2. Answer question ONE and any other TWO questions.**

QUESTION ONE: COMPULSARY

- a) Differentiate between a power set and a universal set. (2marks)
- b) Find the power set of $A = \{1,2,3,4\}$ (3marks)
- c) Given that $U = \{c, d, f, h\}$, $B = \{b\}$, $D = \{a, f, g, h\}$, $E = \{e, f, g\}$ find $(B \cup D^c) \cap (A - E)$ (4marks)
- d) Show that $A - E = A \cap B^c$ (5marks)
- e) Let p be "he is tall" and let q be "He is handsome". Write each of the following proportions in symbolic form using p and q
 - i. He is tall but not handsome
 - ii. It is not true that he is not tall or not handsome
 - iii. He is neither tall nor handsome
 - iv. It is not true that he is not tall or handsome
 - v. He is tall or he is not tall and handsome
 - vi. He is not tall but handsome (6marks)
- f) Suppose that a saleswoman has to visit eight different cities. She must begin her trip in a specified city, but she can visit the other seven cities in any order she wishes. How many possible order can the saleswoman use when visiting this cities? a(3marks)
- g) How many ways are there to select a committee to develop a discrete mathematics course at a school if the committee is to consist of 3 faculty members from the mathematics department and four from the computer

- science department, if there are 9 faculty members of mathematics department and 11 of the computer science department? (4marks)
- h) There are 19 men and 21 women in a room. Of these people 15 are wearing glasses. If 10 men are not wearing glasses, how many women are not wearing glasses. Use a Venn diagram to calculate your answer. (3marks)

QUESTION TWO

- a) i) Differentiate between a tautology and a contradiction. (2marks)
 ii) Verify that the proposition $(p \wedge q) \wedge \sim(p \vee q)$ is a contradiction. (7marks)
 iii) Show that $\sim(p \wedge q)$ is logically equivalent to $\sim p \vee \sim q$ (6marks)
- b) prove that $(A \cap B)^c = A^c \cup B^c$ (5marks)

QUESTION THREE

- a) in a certain group of 100 customers' at Rotich's joint, 60 customers ordered cheese and pepperoni on their pizza. Altogether 80 customers order a pizza with cheese on it and 72 customers ordered pizza with pepperoni on it.
- Illustrate the relationship on the Venn diagram. (2marks)
 - How many customers ordered cheese on their pizza but not pepperoni. (2marks)
 - How many customers ordered pepperoni on their pizza but not cheese? (2marks)
 - How many customers in the group of 100 customers did not order either type of pizza? (2marks)
- b) Explain the following terms giving an example in each case (4marks)
- Real number
 - Rational number
 - Irrational number
 - Equality of set
- c) i) show that $1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$ (4marks)
 ii) simplify $\frac{1}{1+\cos x} + \frac{1}{1-\cos x}$ (4marks)

QUESTION FOUR

- a) Given $A = \{1,2,3,4,5\}$, $B = \{2,4,6,8,10\}$, $C = \{3,4,5,6,7\}$, $U = \{1,2,3, \dots, 12\}$. Find
- $A \cup B$
 - $A \cap B$
 - A^c

- iv. $(B \cup C)^c$ (6marks)
- b) A basket contains 4 a corn squash, 5 gourds and 8 pumpkins. How many ways can 2 a corn squash, 1 gourd, and 2 pumpkins be chosen? (7marks)
- c) $n(u) = 37$, $n(A) = 19$, $n(B) = 13$ and $n(A^c \cap B^c) = 12$. Find $n(A \cap B)$. (7marks)

QUESTION FIVE

- a) Differentiate between infinite sequence and a finite sequence (4marks)
- b) Determine the fourth partial sum of the geometric sequence $2, \frac{1}{3}, \frac{2}{9}, \dots$ (8marks)
- c) Differentiate between a domain and the range as used in the functions and show that $y^2 = x$ does not determine a function of x (8marks)